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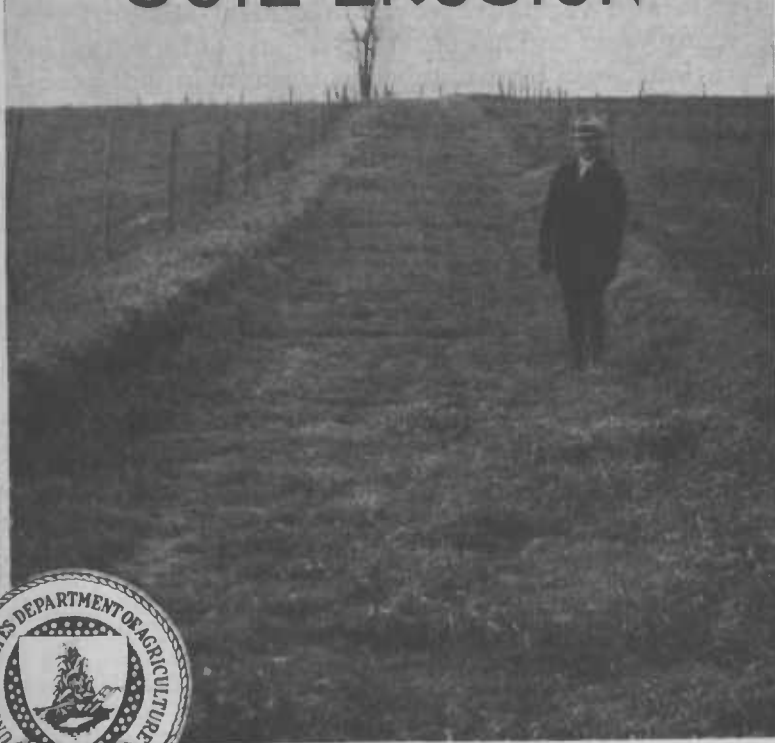
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U. S. DEPARTMENT OF  
AGRICULTURE

FARMERS' BULLETIN No. 1760

*The* USE OF  
BLUEGRASS SOD  
IN THE CONTROL OF  
SOIL EROSION



U. S. DEPARTMENT OF AGRICULTURE  
FARMERS' BULLETIN No. 1700

SINCE THE advent of agriculture in North America as a means of livelihood, various means of controlling gullies have been used. Dams made of earth, rock, brush, fillings of straw, manure, or trash, are among the more primitive experiments toward preventing destructive run-off from torrential rains and seasonal water flow.

Farmers in Missouri, and no doubt in other sections of the country, have successfully employed sod barriers to retard the growth of comparatively small gullies. The author has used bluegrass sod for barriers and vegetative cover in central Missouri for many years and has observed the use of bluegrass in various ways by a number of farmers in gully control. It has proved a highly effective and practical method of checking small washes in cultivated fields and in pastures where gullies have started in live-stock paths.

This bulletin supersedes leaflet no. 82, Controlling Small Gullies by Bluegrass Sod, and is designed to further familiarize farmers with the various ways in which bluegrass may be used as a means of gully control.

# THE USE OF BLUEGRASS SOD IN THE CONTROL OF SOIL EROSION

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## INTRODUCTION

**B**BLUEGRASS SOD has long been used very effectively in controlling soil erosion. Throughout the bluegrass region of the United States, probably no other single means of keeping destructive soil losses under control has been so successful as the use of bluegrass sod on those soils upon which it thrives and on which the velocity of run-off water has not been so great as to destroy the sod itself.

It is true that in most cases where conservation of soil has been accomplished by the use of grass, saving of the soil has been regarded as incidental. Although many farmers have at times made conscious efforts to control erosion by seeding bluegrass or by using the native sod in one way or another, the grass generally has been grown for pastures, lawns, and other purposes. Several years ago, however, a few farmers in Missouri, and probably in other localities, began the successful use of sod barriers to retard the growth of comparatively small gullies, especially in fields of small grain, grass, and alfalfa, and in pastures where gullies started as a result of livestock paths.

## SECURING BLUEGRASS STANDS

Even in those sections of the United States to which bluegrass is adapted, it is not always easy to secure good stands, but good sod is necessary if it is to be really effective in the control of erosion. Bluegrass is not a poor-land crop. It does best in a rather cool, humid climate, and moist, well-watered soils that have at least medium fertility. While it is decidedly partial to limestone soils which also contain liberal amounts of available phosphates it does not grow well on the magnesium-limestone soils of the Ozark section of Missouri and Arkansas, due primarily to the high temperatures of that region. On the other hand a soil with a high lime content is not always essential for a good growth of bluegrass.

Where conditions are favorable to the growth of bluegrass it will usually thrive if given an opportunity. The seeding of bluegrass, therefore, on pastures, gully banks, or other places not in cultivation, is not to be recommended without some seedbed preparation, soil treatment, and possibly some protection from overgrazing. The lack of soil fertility is usually the limiting factor. Where this is the case the application of barnyard manure will make possible a good growth from a new seeding.

It is often assumed, and some experimental results have indicated, that the response of bluegrass to phosphate fertilizers is indirect, the growth increasing only after legumes have become a more pronounced part of the flora. There is, however, much evidence that the use of superphosphate on land low in available phosphorus has considerable direct effect in increasing the stand and in improving the growth of bluegrass.

When old thin stands of bluegrass are to be improved by reseeding and fertilizing, the sod should usually be cut with a disk to help prepare a seedbed. Seed is not recommended if a fair stand of grass is present, as the application of fertilizer will cause the grass to spread rapidly and form a good cover without the expense of adding seed. The fertilizer should be worked well into the soil, preferably by means of a fertilizer drill. If a drill is not available the fertilizer may be disked in, but the results are usually not as satisfactory. The best rate of application usually ranges from 200 pounds up to 350 or 400 pounds an acre. Either superphosphate or complete fertilizer with high phosphorus content may be used.

The nitrogen content of the fertilizer may be lessened by using a seed mixture of 6 to 8 pounds of alsike clover, red clover, white clover, and lespedeza on these old pastures, together with fertilizer of high phosphate content at rates indicated above. These legumes add nitrogen and organic matter to the soil and the bluegrass will increase until a good sod is established.

Rarely should bluegrass be seeded alone, whether in thickening an old stand or in a new seeding. If there is already a partial stand, proper soil treatment and supplementary seeding with a mixture of other grasses, especially legumes, will hasten the formation of a good sod. Other grass seeds frequently used in varying amounts in such mixtures are timothy, orchard grass, brome grass, and redtop.

On certain well-drained soils which are low in plant nutrients, a good stand of bluegrass may be secured by first liming and manuring or fertilizing the land and seeding to alfalfa or sweetclover, together with 3 to 6 pounds of bluegrass seed.

With new seedings where dense stands are desired quickly, as on gully banks and in terrace outlets, the application of 300 to 400 pounds of complete fertilizer is recommended, and the rate of seeding of the desired mixture may be increased to 25 pounds an acre. Rarely is it advisable to seed more than this amount.

Bluegrass may be seeded in early spring, late summer, or very early fall. For spring seedings especially, throughout the Corn Belt, it is best to use a nurse crop of barley or oats seeded at approximately half the normal rate. The seed should always be covered lightly. When a nurse crop is used better and quicker stands are secured by either clipping the nurse crop or removing it early for hay.

## SODDING

Sometimes, where the immediate or rapid establishment of a dense bluegrass sod is essential for the control of erosion, sodding must be resorted to. Because of the labor involved in cutting, transporting, and placing sod, this practice is generally limited to small areas where seeding alone is not practicable, as in connection with the preparation of terrace outlets and headers for small gullies. The combined use of sod strips and seedings often proves advantageous on the larger areas.

Where a considerable amount of sodding is necessary the use of a sod cutter such as that illustrated in figure 1 may be used to advantage. This cutter can be made by any blacksmith at a cost

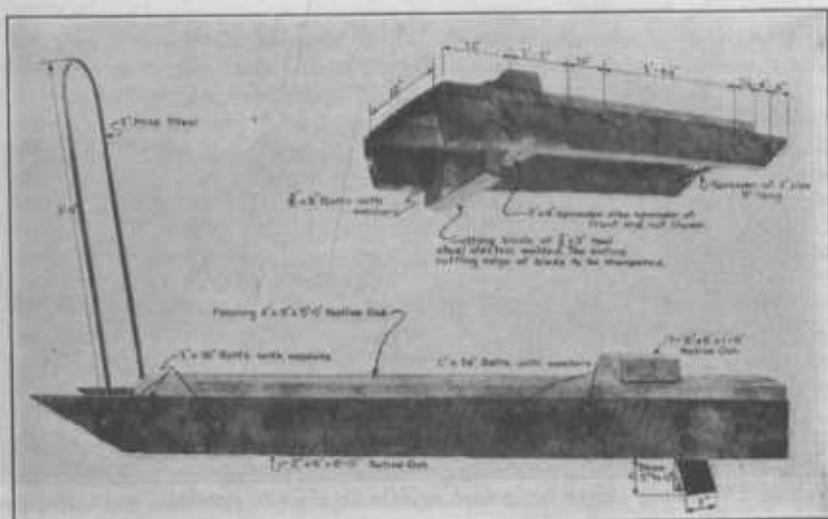


FIGURE 1.—With this simple implement sod strips can be cut quickly and cheaply.

of from \$5 to \$7. The cutter may be pulled by a team, by a tractor, or by a heavy truck; and it will cut from 1,000 to 2,000 square yards of sod an hour.

Ordinarily, the sod strips should be cut from 2 to 4 inches thick, depending on the season of the year, the amount of moisture available, and the fertility of the soil where the sod is to be used. Enough soil should be left on the roots to assure successful growth, especially in late spring, summer, or late fall when conditions are not favorable for quick growth. Where the sod is to be placed on naturally fertile soil or on a layer of fertile soil spread ahead of sodding, it should be cut as thin as possible in order to hasten the growth of the roots into the soil beneath. The newly placed sod should be well tramped, and it is generally a good practice to rake some fine dirt over the surface, thereby filling in all spaces between the strips. Sod strips can be used successfully at times of the year when seedings might be expected to fail.

To secure effective sod strips, an effort should be made to find a dense bluegrass sod as free as possible from weeds and trash. The sod should be cut in strips at right angles to the slope of the land

and each strip cut should be separated from the next by a strip of uncut sod. This will prevent the starting of gullies and will facilitate the formation of new sod on the bare places.

#### USE OF SOD IN BAGS

Barriers or checks in small gullies may sometimes be made by placing short strips of bluegrass sod in old burlap feed or fertilizer bags and then placing the bags across the bottom of the small washes, as shown in figure 2. This method has been used by a number of Missouri farmers for several years and has been employed successfully by the erosion experiment station at Bethany, Mo., since 1931, and



FIGURE 2.—Sod-bag checks being used to control a small gully in a cultivated field.

by the Soil Conservation Service during 1934-35. Feed bags with fair-sized holes and coarse-mesh fertilizer bags considered worthless for any other purpose are entirely satisfactory. After the sod has been cut into small squares or rectangles it is placed in the bags. The bags are then securely placed in the gully to form dams, with their centers downstream and their ends extending up the sides of the small gully so that the water may run over the centers and not form new washes around the ends of the bags. Open-mesh or loosely woven bags are preferable because they allow the grass to grow more readily through the meshes of the bags to form a dense sod. By the time the bags have rotted away, the barrier is well established and offers no obstacle to the operation of farm implements. The bluegrass spreads and each rain deposits soil on the grass and above the dam. As the grass grows through this deposit and spreads above the dam the wash gradually fills, and the sod effectively holds the soil in the small washes. Correspondingly larger checks than those illustrated may be found effective in the larger gullies.

Ordinarily the sod bags should be placed in shallow trenches. This will (1) assure a better contact with the soil thereby preventing excess loss of moisture, and (2) prevent the formation of too great

an overfall, which might tend to cut back after the burlap had disintegrated, or cause undermining immediately below the bag check. When properly placed, the bag checks serve to prevent continued washing and to catch and hold enough silt to make possible the establishment of a good sod all the way up and down the gully. It is generally best to seed a mixture of grasses, including bluegrass, on the sides and bottom of the gully between checks.

In many places the sod bags should be staked or otherwise secured to the ground to prevent their washing away before the sod has become well established. Small stakes may be driven through the bags and into the ground, but large staples of no. 9 wire have proved more effective. For best results such staples should be made about 1 foot long.

The Soil Conservation Service in northern Missouri and southern Iowa has demonstrated that better results can often be secured by spreading a small handful of mixed grass seeds over the sod within the bag before it is placed. If dry weather should kill the sod before the roots make contact with the soil beneath, this seed may be expected to take root when sufficient moisture is provided.

In some localities it may be impossible to secure good bluegrass sod to place in bags as explained above. In such cases the bag may be partly filled with good soil and placed in proper position in the gully. Then a small handful of grass-seed mixture containing bluegrass may be put into the upper part of the soil in the bag. In this case the bag aids in retaining the moisture in the soil which it contains and prevents the washing away of the seed before it has a chance to germinate and produce a sod. If the soil used is not fertile, it is advisable to mix a little barnyard manure, commercial fertilizer, or both, with it before it is placed in the bags, because in many washes where the bags are to be used, the subsoil has been exposed. Highly fertile soil, therefore, is required to produce a good sod within a reasonably short time.

The best results from sodding work, with or without bags, have been secured by placing the sod during the period from about the middle of March to the 1st or 10th of May, or in the fall during September or October.

#### STABILIZING GULLY BANKS WITH BLUEGRASS SOD

The satisfactory solution of an erosion problem lies largely in following nature's methods. For the economical control of gullies, vegetation must be relied upon largely, except in those special cases where the velocity and quantity of the run-off is too great to permit the ready establishment of a good vegetative cover.

Bluegrass sod is effective in helping to stabilize the banks of fairly deep and troublesome gullies. As the banks become less steep the grass gains a foothold, spreads, covers, and stabilizes them. A little help from the farmer greatly hastens the natural course of this process. The steep banks should be plowed in to reduce their slope, sod strips should be placed along the sides of the gully, and a mixture of timothy, redtop, bluegrass, clover, and lespedeza seeded over the entire gully. In working down the sides, the ground should be left rough so that the seed may be lightly covered and still not wash away. If the soil is poor, as is very likely to be the case, an applica-



tion of barnyard manure or a good mixed fertilizer will greatly accelerate the growth of grass and the formation of a dense sod.

If the drainage area is large, some mechanical checks of woven wire, brush, or rock may be needed in the bottom of the gully to prevent further cutting. Although this method usually will not cause the gully to completely fill, it will help prevent its growth and branching. The purpose of the checks is to flatten out the bottom of the gully and so make possible the growth of vegetation.

Gullies so treated should always be protected from trampling by livestock, which probably more than any other one thing prevents the successful growth of vegetation on gullied areas.



FIGURE 3.—Black locust trees set on the banks of a steep gully in Iowa. Although but 18 months old, the trees are well established.

It may be practicable to set trees or shrubs such as black locust along the sides of gullies too large to be filled, as shown in figure 3. Especially when well manured, they will grow rapidly even on exposed subsoil, will not shade the ground too much for bluegrass, will aid in stabilizing the banks, and ordinarily will produce excellent fence posts in 10 or 12 years.

Willows, or in some places cottonwoods, may be set at intervals across the bottoms of the gullies, which are usually wet and therefore well suited to either of these species. The trees will produce living checks within a short time and will aid in filling the gullies or at least prevent further cutting.

#### SOD CHECK DAMS

In the smaller drainage areas where the soil type will support a good growth of sod, a sod check dam such as is diagrammatically shown in figure 4 may be used successfully. In the construction of this type of check dam, small earth dams are placed at intervals along the gully bottom. These earth dams should be constructed with an upstream slope of at least 2 or 3 to 1 with the bottom of the gully, and a downstream slope of at least 3 to 1.

The downstream slope of the earth dam is then covered with sod strips placed in such a manner that the joints between the strips are staggered. The sod strips should cover the entire downstream

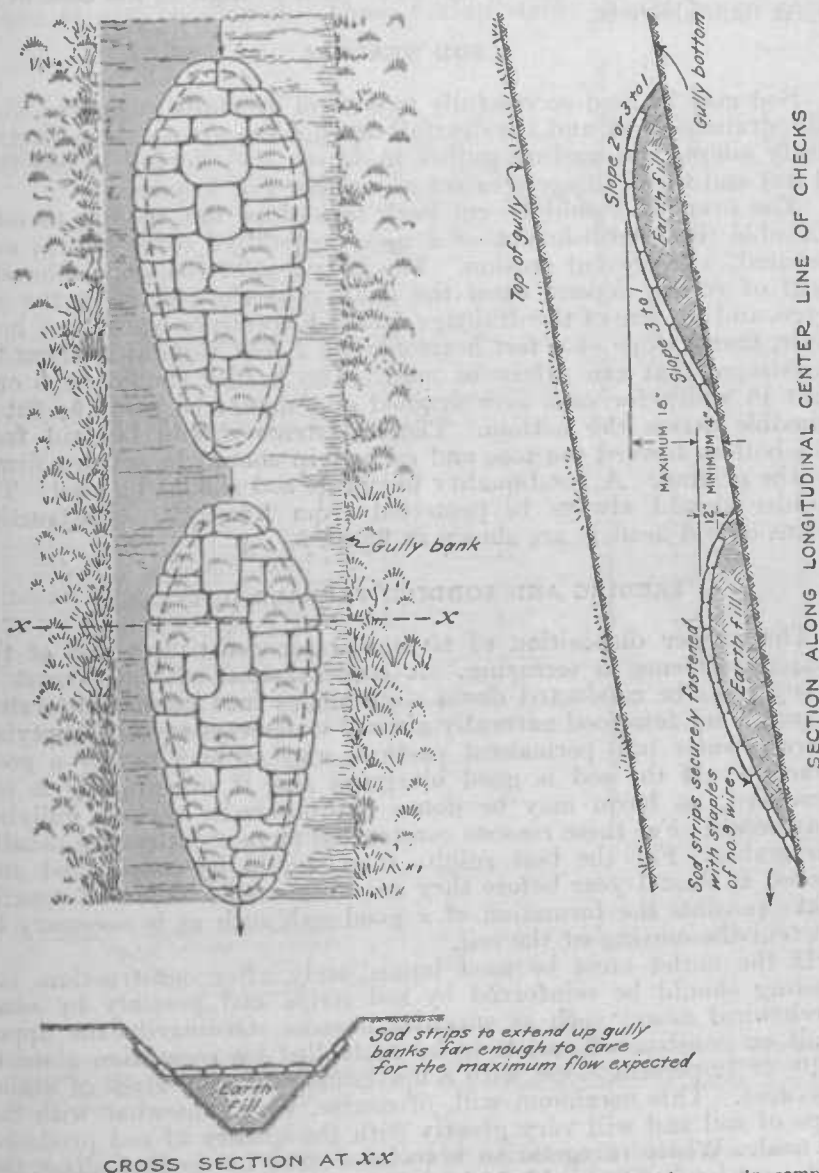


FIGURE 4.—Diagrammatic representation of sod check dams suitable for use in comparatively small gullies.

slope of the dam and extend up the sides of the gully far enough to form a sodded trench large enough to carry the maximum run-off. The sodded portion should extend upstream over the top of the dam and down along the upstream face a distance of at least 18 inches.

After the sod has been properly placed, it must be securely fastened down by means of staples formed of no. 9 wire. In determining the proper spacing of the sod check dams in the gully it is important that the top of each check dam be at least as high as the base of the next dam above it.

#### SOD HEADERS

Sod may be used successfully to control overfalls in gullies where the drainage area and the overfall are not too great. It is particularly adapted to pasture gullies in which the overfall is less than 4 feet and the drainage area not more than 4 or 5 acres.

The overfall should be cut back to a slope flat enough to make possible the establishment of a good vegetative cover which, once secured, will prevent erosion. The steepness of the slope allowable will of course depend upon the quality of the sod used, the soil type, and the size of the drainage area. Experience has shown, however, that a slope of 4 feet horizontal to 1 foot vertical is about the maximum that can safely be used. The header should be 3 or 4 feet in width for each acre drained and should be made as flat as possible across the bottom. The sod strips should be laid from the bottom toward the top, and each strip should be stapled firmly to the ground. A good-quality bluegrass sod should be used. The header should always be protected from livestock. Construction plans of sod headers are shown in figure 5.

#### SEEDING AND SODDING TERRACE OUTLETS

The proper disposition of terrace water constitutes one of the major problems in terracing. A concentration of water must in many cases be conducted down steep slopes into permanent waterways. Very few good naturally grassed waterways exist. Emptying terrace water into permanent pastures may or may not be a good practice. If the sod is good bluegrass and if overgrazing is not practiced, no harm may be done; but otherwise serious gullying may result. For these reasons constructed terrace outlets are usually preferable. For the best results they should be constructed and seeded at least 1 year before they are to be used. This will usually make possible the formation of a good sod, such as is necessary to prevent the cutting of the soil.

If the outlet must be used immediately after construction, the seeding should be reinforced by sod strips and possibly by some mechanical means such as spreader boards. Ordinarily the upper limit on constructed outlets to be controlled by vegetation alone is a 10- or 12-percent slope, with a maximum of 5 or 6 acres of drainage area. This maximum will, of course, vary somewhat with the type of soil and will vary greatly with the quality of sod produced or used. Where revegetation is to be secured by seeding alone, the soil must be fertile or should be made so by liberal use of barnyard manure or a mixed fertilizer. The use of manure is definitely preferable. On steep or severely eroded outlets complete sodding may be necessary. On outlets not so steep and on which some of the good topsoil still remains sod strips placed from 2 to 5 feet apart are usually sufficient. The areas between should be fertilized and seeded;

again it should be emphasized that in such places barnyard manure is more effective than commercial fertilizer.

Burlap strips may be used to advantage over the new seeding at the points where the terraces empty into the outlet ditch if such places cannot be sodded. These burlap strips should be removed

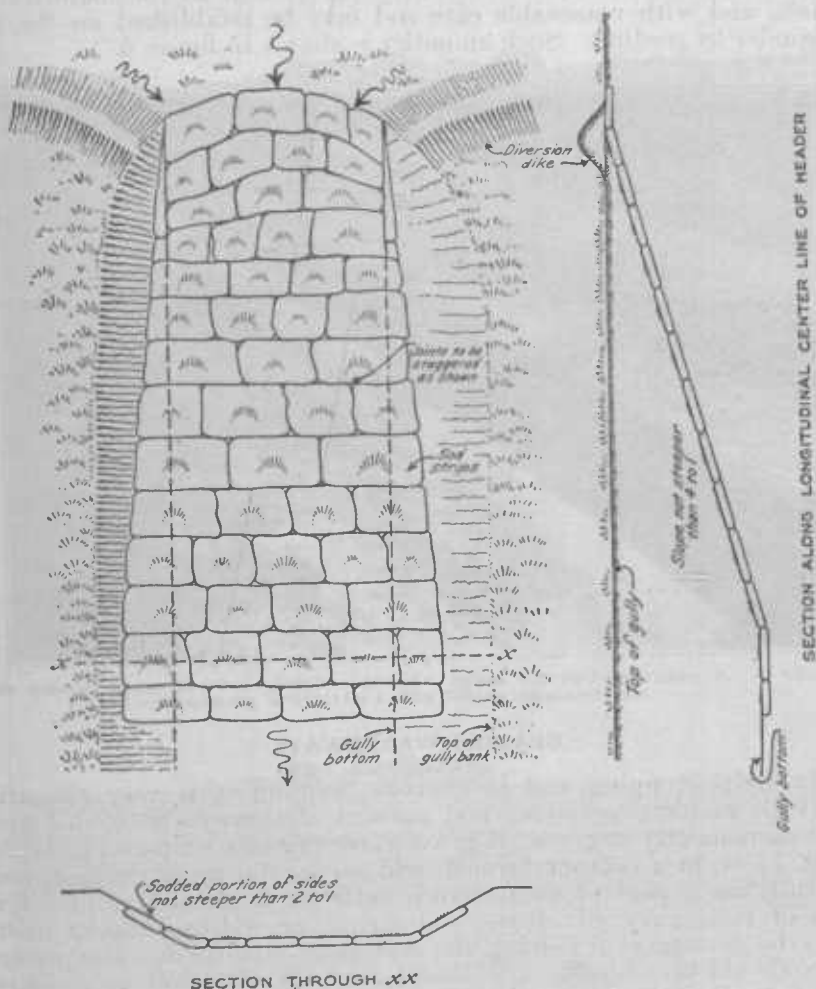


FIGURE 5.—Sod headers such as diagrammatically represented here are very effective in checking the advance of comparatively small gullies into fertile pasture lands or into cultivated fields. All sod strips are to be held securely in place by staples formed of no. 9 wire.

after the grass has reached a height of about 2 inches, unless the burlap is open-meshed or quite old and easily disintegrated. The burlap should be fastened securely to the ground by means of wire staples.

The sod strips should be placed on the level and flush with the remainder of the channel. This is very important because if the sod strip is higher than the channel floor, small overfalls are almost sure

to develop. These strips should also be securely stapled to the ground.

Some success has been secured with outlets the center of which is constructed slightly lower than the remainder of the ditch, and completely sodded for not more than about one-third of the total width of the outlet. This part will carry the run-off in the majority of cases, and with reasonable care sod may be established on the remainder by seeding. Such an outlet is shown in figure 6.

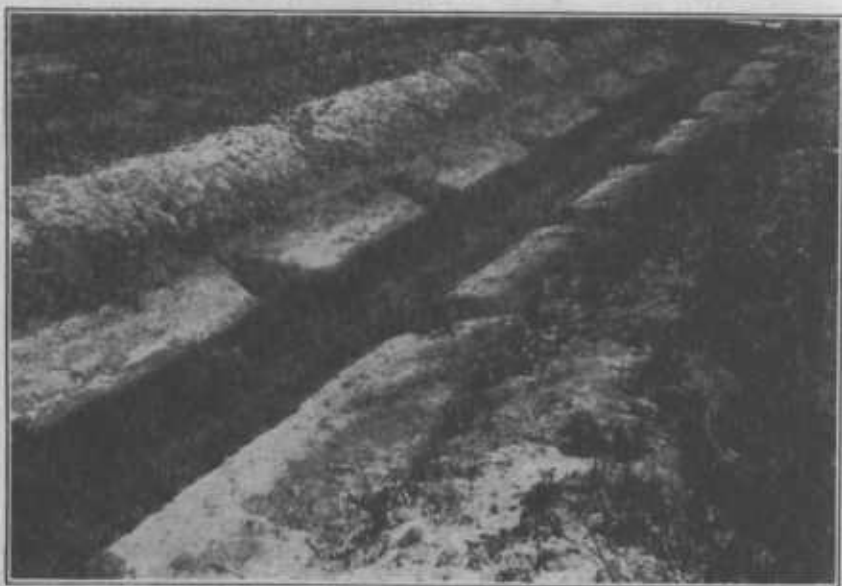


FIGURE 6.—A constructed-terrace outlet with the slightly lowered center sodded and the remainder seeded with a mixture of grasses.

#### GRASSED WATERWAYS

In strip cropping and in contour farming it is very essential that all major depressions and natural waterways be seeded and left permanently in grass. A grass waterway in a strip-cropped field (fig. 7) or in a contour-farmed field serves the same purpose, and is fully as important as a terrace outlet in a terraced field. The use of temporary structures, sod strips, or sod-bag checks often may be necessary in getting the waterway stabilized. The waterway should be seeded to a width of from 20 or 30 feet up to 75 or 100 feet, depending upon the amount of water to be carried and the percent of slope on each side of the waterway (fig 8). The grass strip should be wide enough to extend well back upon the shoulders of the gully or waterway. Great care should be taken not to get the sodded strip too narrow. These seeded waterways should always be crossed at right angles when plowing, and the plow or other farming implement should be lifted out of the ground at the edge of the strip to avoid destroying the sod. The edges of the grassed strip should be left quite irregular in order to prevent the formation of a new gully along the sides. Plowing should never be parallel to the side of the grass strip as this also is likely to cause the

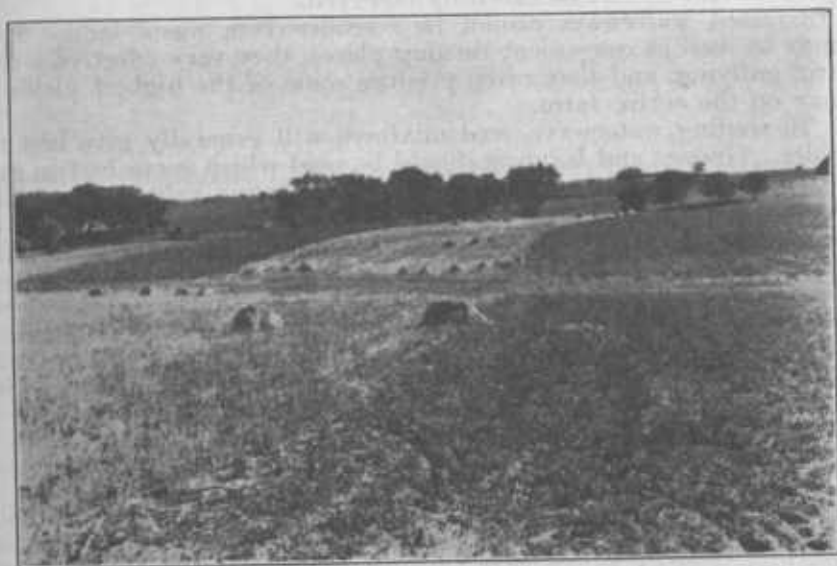


FIGURE 7.—The excess water from this strip-cropped field is carried off safely by the waterway which is left permanently in grass. Farm implements are lifted out of the ground as the waterway is crossed.



FIGURE 8.—Leaving the waterway grassed prevents the formation of a gully in this cultivated field. A valuable crop of hay is cut from this waterway each year. Note the irregular edge of the plowed area.

formation of an extra gully at that place. This precaution is important and should be carefully observed.

Grassed waterways cannot be considered as waste land. They may be used as convenient turning places, they very effectively control gullying, and they often produce some of the highest yields of hay on the entire farm.

In seeding waterways, seed mixtures will generally give best results. Grasses and legumes should be used which serve best in controlling erosion and at the same time constitute a valuable hay crop. Ordinarily a little bluegrass should be added for the production of a denser sod. Where the ground is poorly drained, as is often the case, a mixture of 7 pounds of timothy, 5 pounds of reedtop, 3 pounds of reed canary, 2 pounds of bluegrass, and 3 pounds of alsike clover an acre may be used. Such seeding should be done on prepared ground either in the early spring, late summer, or early fall. In most cases early spring seedings give the best results if planted with a nurse crop seeded at a light rate.

#### MAINTENANCE OF BLUEGRASS SOD

A dense sod is necessary to effectively control erosion, especially on steep slopes. Bluegrass sod, to remain dense throughout the year, must be well fed and watered. Bluegrass should be rather sparingly grazed, if at all, during the hot, dry, summer months and should be allowed to go into the winter months with a good vegetative growth. This will allow it to store up in the underground parts the reserve material so necessary for a vigorous early growth the following spring.

Terrace outlets, grassed waterways, and bluegrass buffer strips should always be clipped a sufficient number of times each year to prevent seed formation and weed growth. Even the grass on the gully banks should be cut occasionally for the best results.

When bluegrass begins to show signs of thinning out or when the vegetative growth becomes weak it is a fairly good indication of depleted soil fertility. The best cure for this condition is a well-distributed application of barnyard manure. If this is not available, a complete fertilizer fairly high in phosphate should be liberally applied and well worked into the ground.

Terrace outlets, sod dams, sod strips, and similar soil-conserving vegetation should be carefully inspected after each heavy rain in order to note the weakened places and small washes which should be repaired to prevent serious damage. Proper maintenance is quite as important as correct methods of establishing the sod in the beginning.

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